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ABSTRACT

With mounting interest in what research has shown about learning through computer assisted instruction (CAI), several research analysts have recently reviewed the CAI research for the past 20 years. Each review comes up with a set of conclusions that are fairly consistent with other reviews, and the conclusions from six of these studies are summarized in this digest as a guide for educators who want the essence of the research rather than comprehensive reports. These conclusions indicate that there is sufficient evidence to suggest a strong motivational element in computer use by students; continued use of computers lessens the initial motivation and tends to reduce retention; and the heightened effectiveness of CAI with elementary and secondary students is substantially reduced at the higher education level. (RP)

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ERIC DIGEST

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A REVIEW OF REVIEWS OF RESEARCH ON COMPUTER ASSISTED INSTRUCTION

With mounting interest in what research has shown about learning through CAI (computer assisted instruction, also known as CBI—computer based instruction, and CAL—computer assisted learning), several research analysts have recently reviewed the CAI research for the past 20 years. Each review comes up with a set of conclusions that are fairly consistent with other reviews. Some of these conclusions are listed here as a guide for educators who want the essence of the research rather than comprehensive reports. Such digests can be misleading, so the reader is advised to read the original review article. For further detail, the original report of the research is the best source.

Gerald W. Bracey. "What the Research Shows." *Electronic Learning* (November/December 1982): 51-54.

This highly readable article reviews a few large scale research projects as it considers: (1) achievement outcomes, (2) affective/motivational outcomes, and (3) social outcomes. The conclusion states:

> In general, students learn more, retain more, or learn the same amount faster using computers. Unfortunately, no studies have been completed yet that tell us *why* that may be. Achievement gains aside, students often find computers more "human"—more patient, less critical—than humans. (p. 52)

Glenn Fisher. "Where CAI is Effective: A Summary of the Research." *Electronic Learning 3* (November/December 1983): 82, 84.

This brief article reports the conditions necessary for effective CAI without citing any specific research studies—targeted student population, integration with instruction, selection of subject areas, and establishment of proper setting and scheduling. The five annotated references are themselves reviews of research. His conclusion:

> CAI is an effective use of computers—for certain students, in some subject areas,* as a supplementary activity. Besides increasing student achievement, it also changes student attitudes and behaviors, apparently in positive ways. Used wisely, it can be a powerful and effective tool to help students gain control of their own education, both in achievement and attitude. (p. 84)

*According to this article, "CAI appears most effective when it's integrated with regular science and foreign language instruction, and used with either low or high achieving students" (p. 82).

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G. Kearsley, B. Hunter and R. J. Seidel. "Two Decades of Computer Based Instruction Projects: What Have We Learned?" *T.H.E. Journal 10* (January 1983): 90-94; *10* (February 1983): 88-96.

This comprehensive review written by a team of well-known CAI professionals focuses on nine major outcomes of the 20 years of research that is reviewed in sufficient detail to be helpful but not overwhelming. These outcomes are:

(1) There is ample evidence that computers can make instruction more efficient or effective.

(2) We know relatively little about how to individualize instruction.

(3) We do not have a good understanding of the effects of instructional variables such as graphics, speech, motion, or humor.

(4) A great deal has been learned about overcoming institutional and organizational inertia and resistance to change in the context of implementing CBI.

(5) Significant progress has been made on the development of authoring tools and techniques for CBI.

(6) Good mechanisms have been developed for the dissemination of CBI ideas and courseware.

(7) CBI has spurred research throughout the entire field of instruction.

(8) Federal funding has played a pivotal role in advancing CBI.

(9) We have just scratched the surface of what can be accomplished with computers in education. (January, p. 90)

J. Kulick, R. Bangert, and G. Williams. "Effects of Computer-Based Teaching on Secondary School Students." *Journal of Educational Psychology 75* (February 1983): 19-26.

Currently quoted more frequently than any other single article, this review uses meta-analysis to integrate findings from 51 separate evaluations of CAI in grades 6-12:

> The analysis showed that computer-based teaching raised students' scores on final examinations by approximately .32 standard deviations, or from the 50th to the 63rd percentile.

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Computer-based instruction also had smaller, positive effects on scores on follow-up examinations given to students several months after the completion of instruction. In addition, students who were taught on computers developed very positive attitudes toward the computer and positive attitudes toward the courses they were taking. Finally, the computer reduced substantially the amount of time that students needed for learning. (p. 19)

Jesse Orlansky. "Effectiveness of CAI: A Different Finding." *Electronic Learning 3* (September 1983): 58, 60.

This review of CAI research in a different setting points out that findings about student achievement with CAI are inconsistent between military training and conventional education programs. It is suggested that this discrepancy may be due to the different purposes for the instruction, limited time for military training, and the difference between education and training.

> In military training . . . achievement with CAI has been found to be about the same, but not significantly better, as that with conventional instruction. What is significantly better with computer-based instruction is that it saves students time in attaining the required minimum levels of knowledge and skills without a loss of student achievement. (p. 58)

Marie Dence. "Toward Defining the Role of CAI: A Review." *Educational Technology 20* (November 1980): 50-54.

This article reviews 17 major CAI studies published between 1969 and 1978 with specific attention to the variables being studied. The conclusion is that:

> The results of CAI research thus far have not been definitive. A review of studies using CAI under different conditions and comparing it to traditional methods of instruction reveals an abundance of no-significant differences between the two methods. Yet, the results of each study help to define those variables important for future research. (p. 51)

The variables reported are: subject matter, type of CAI, branching, student attitudes, feedback, individualization, CAI versus traditional instruction, time, retention, and student variables.

Conclusions

After reviewing the research reviews, one is not impressed with overwhelming research evidence for the use of computer-assisted instruction. There is the feeling that computers can be used for certain instructional tasks (such as tutorials, drill and practice, problem solving, simulations, inquiry, and dialogs); in certain subject fields especially science, mathematics and foreign language; with certain types of learners (usually high and low achievers but not as frequently with average achievers). There is sufficient evidence to suggest a strong motivational element in computer use by students. Continued use of computers lessens the initial motivation and tends to reduce retention. The heightened effectiveness of CAI with elementary and secondary students is substantially reduced at the higher education level.

All writers agree that much more research needs to be done and that comparisons of CAI and traditional instruction are of little use.

This digest was prepared by Donald P. Ely, Director, ERIC Clearinghouse on Information Resources, Syracuse University, Syracuse, New York. April 1984.

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